

## CLAIMS

The invention claimed is:

1. A deposition apparatus, comprising:  
a substrate susceptor for receiving a semiconductor wafer substrate;  
one or more lamps for providing radiant energy to the substrate; and  
at least one of the lamps having a reflector associated therewith for reflecting radiant energy from said at least one of the lamps toward the substrate, said reflector having a rugged reflective surface configured to disperse the radiant energy reflected therefrom.
2. The apparatus of claim 1 wherein the rugged reflective surface comprises a repeating pattern.
3. The apparatus of claim 1 wherein the repeating pattern extends entirely across the rugged reflective surface.
4. The apparatus of claim 1 wherein the rugged reflective surface comprises a repeating pattern of dimples.

5. The apparatus of claim 1 wherein the rugged reflective surface is a surface of a crumpled metallic foil.

6. The apparatus of claim 1 wherein the rugged surface is a first disperser and further comprising passing at least some of the dispersed radiant energy through a second disperser prior to providing the radiant energy to the substrate.

7. The apparatus of claim 6 wherein the second disperser comprises a diffraction grating.

8. The apparatus of claim 1 wherein two adjacent lamps provide radiant energy to the substrate, and wherein there is sufficient dispersion of energy from the lamps that at least 50% of the radiant energy impacting the substrate from one of the lamps is overlapped by radiant energy impacting the substrate from the other of the lamps.

9. The apparatus of claim 8 wherein said two adjacent lamps are comprised by a bank of lamps having outer lamps at the outer periphery of the bank and having inner lamps between the outer lamps, and wherein the adjacent lamps are both inner lamps of the bank of lamps.

10. The apparatus of claim 9 wherein said bank of lamps consists of four lamps, with two of the lamps being the outer lamps and two of the lamps being the adjacent inner lamps.

11. The apparatus of claim 8 wherein there is sufficient dispersion of energy from the lamps that at least 70% of the radiant energy impacting the substrate from one of the lamps is overlapped by radiant energy impacting the substrate from the other of the lamps.

12. The apparatus of claim 11 wherein said two adjacent lamps are comprised by a bank of lamps having outer lamps at the outer periphery of the bank and having inner lamps between the outer lamps, and wherein the adjacent lamps are both inner lamps of the bank of lamps.

13. The apparatus of claim 12 wherein said bank of lamps consists of four lamps, with two of the lamps being the outer lamps and two of the lamps being the adjacent inner lamps.

14. The apparatus of claim 8 wherein there is sufficient dispersion of energy from the lamps that at least 90% of the radiant energy impacting the substrate from one of the lamps is overlapped by radiant energy impacting the substrate from the other of the lamps.

15. The apparatus of claim 14 wherein said two adjacent lamps are comprised by a bank of lamps having outer lamps at the outer periphery of the bank and having inner lamps between the outer lamps, and wherein the adjacent lamps are both inner lamps of the bank of lamps.

16. The apparatus of claim 15 wherein said bank of lamps consists of four lamps, with two of the lamps being the outer lamps and two of the lamps being the adjacent inner lamps.

17. A deposition apparatus, comprising:  
a substrate susceptor for receiving a semiconductor wafer substrate;  
one or more lamps for providing radiant energy to the substrate, the  
radiant energy being in the form of light waves; and  
a disperser between at least one of the lamps and the substrate; at  
least some of the light waves being passed through the disperser prior to providing  
radiant energy to the substrate.
18. The apparatus of claim 17 wherein the disperser comprises a  
diffraction grating.
19. The apparatus of claim 18 wherein the susceptor is within a reaction  
chamber and wherein the disperser is outside of the reaction chamber.
20. The apparatus of claim 18 wherein the susceptor is within a reaction  
chamber and wherein the disperser is within the reaction chamber.

21. The apparatus of claim 17 wherein two adjacent lamps provide radiant energy to the substrate, and wherein there is sufficient dispersion of energy from the lamps that at least 50% of the radiant energy impacting the substrate from one of the lamps is overlapped by radiant energy impacting the substrate from the other of the lamps.

22. The apparatus of claim 17 wherein two adjacent lamps provide radiant energy to the substrate, and wherein there is sufficient dispersion of energy from the lamps that at least 70% of the radiant energy impacting the substrate from one of the lamps is overlapped by radiant energy impacting the substrate from the other of the lamps.

23. The apparatus of claim 17 wherein two adjacent lamps provide radiant energy to the substrate, and wherein there is sufficient dispersion of energy from the lamps that at least 90% of the radiant energy impacting the substrate from one of the lamps is overlapped by radiant energy impacting the substrate from the other of the lamps.

24. A method of assessing alignment of semiconductor wafer substrate within a deposition apparatus, comprising:

providing a deposition apparatus having a substrate susceptor for receiving a semiconductor wafer substrate, having one or more laser emitters configured to reflect laser light from the substrate, and having one or more photodetectors configured to detect the reflected laser light;

providing a semiconductor wafer substrate received by the susceptor;

emitting light from at least one of the laser emitters toward the substrate such that at least some of the light reflects from the substrate to at least one of the photodetectors;

detecting the emitted light with said at least one of the photodetectors;

and

utilizing information about the detected light to assess alignment of the substrate.

25. The method of claim 24 further using the information about the detected light to make susceptor adjustments to improve the alignment; and wherein the utilization of the information and improving of alignment comprises making susceptor adjustments until an approximately maximum signal is received by the photodetector.

26. The method of claim 25 two or more of the laser emitters are utilized together with two or more of the photodetectors, wherein each of the laser emitters is paired with one of the photodetectors, and wherein the utilization of the information and improving of alignment comprises making susceptor adjustments until approximately maximum signals are received by all of the photodetectors.

27. The method of claim 24 wherein the susceptor utilized to spin the substrate, and wherein the emitting light and detecting the emitted light is conducted while the substrate is spinning.

28. The method of claim 24 two or more of the laser emitters are utilized together with two or more of the photodetectors, and wherein each of the laser emitters is paired with one of the photodetectors.

29. The method of claim 24 two to four of the laser emitters are utilized together with two to four of the photodetectors, and wherein each of the laser emitters is paired with one of the photodetectors.



30. The method of claim 24 wherein the susceptor is within a reaction chamber, and wherein said at least one of the laser emitters and at least one of the photodetectors are also within the reaction chamber.

31. The method of claim 24 wherein the susceptor is within a reaction chamber, and wherein said at least one of the laser emitters and at least one of the photodetectors are not within the reaction chamber.

32. A method of assessing the thickness of a deposited layer within a deposition apparatus, comprising:

providing a deposition apparatus having a substrate susceptor for receiving a semiconductor wafer substrate, having one or more laser emitters configured to reflect laser light from the substrate, and having one or more photodetectors configured to detect the reflected laser light;

providing a semiconductor wafer substrate received by the susceptor;

depositing a layer onto the substrate;

emitting light from at least one of the laser emitters toward the substrate such that at least some of the light reflects from the substrate to at least one of the photodetectors;

detecting the emitted light with said at least one of the photodetectors;

and

utilizing information about the detected light to assess the thickness of the deposited layer on the substrate.

33. The method of claim 32 wherein the information utilized to assess the thickness of the deposited layer on the substrate includes a location of the detection of the emitted light on the detector.

34. The method of claim 32 wherein the susceptor is within a reaction chamber, and wherein said at least one of the laser emitters and at least one of the photodetectors are also within the reaction chamber.

35. The method of claim 32 wherein the susceptor is within a reaction chamber, and wherein said at least one of the laser emitters and at least one of the photodetectors are not within the reaction chamber.

36. A method of assessing the thickness of a deposited layer within a deposition apparatus, comprising:

providing a deposition apparatus having a substrate susceptor for receiving a semiconductor wafer substrate;

providing a semiconductor wafer substrate received by the susceptor, the substrate covering a first portion of the susceptor and leaving a second portion of the susceptor not covered;

depositing a material onto the substrate and over the second portion of the susceptor; and

optically determining a thickness of the material over the second portion of the susceptor.

37. The method of claim 36 further comprising estimating the thickness of the deposited material over the substrate utilizing the assessed thickness of the deposited material over the second portion of the susceptor.

38. The method of claim 36 wherein the deposited material comprises silicon.

39. The method of claim 36 wherein the deposited material consists essentially of silicon.

40. The method of claim 36 wherein the deposited material consists of silicon.

41. The method of claim 36 wherein the deposited material comprises silicon/germanium.

42. The method of claim 36 wherein the deposited material consists essentially of silicon/germanium.

43. The method of claim 36 wherein the deposited material consists of silicon/germanium.

44. The method of claim 36 wherein the optically determining utilizes ellipsometry.

45. The method of claim 36 further comprising, prior to providing the substrate to be received by the susceptor, treating the susceptor to enhance deposition of the material over the second portion of the susceptor.

46. The method of claim 45 wherein the deposited material is a second material, and wherein the treating comprises depositing a first material over the second portion of the susceptor.

47. The method of claim 46 wherein the first and second materials both comprise silicon.

48. The method of claim 46 wherein the first and second materials are the same composition as one another.

49. The method of claim 46 wherein the substrate is a first substrate and is removed from over the susceptor after the second material is deposited onto the first substrate, the method further comprising providing a second substrate onto the susceptor, and, prior to providing the second substrate, removing the second material from over the second portion of the susceptor.

50. The method of claim 46 wherein the substrate is a first substrate and is removed from over the susceptor after the second material is deposited onto the first substrate, the method further comprising providing a second substrate onto the susceptor, and, prior to providing the second substrate:

removing the first and second materials from the second portion of the susceptor; and

after removing the first and second materials, re-depositing first material onto the second portion of the susceptor.

51. A method of assessing the thickness of a deposited layer within a deposition apparatus, comprising:

providing a deposition apparatus having a substrate susceptor for receiving a semiconductor wafer substrate, having one or more emitters configured to emit light toward a surface of the susceptor, and having one or more detectors configured to detect the emitted light;

providing a semiconductor wafer substrate received by the susceptor, the substrate covering a portion of the susceptor and leaving a surface of the susceptor not covered;

depositing a material onto the substrate and over the surface of the susceptor;

emitting light from at least one of the emitters toward the susceptor surface such that at least some of the light passes onto or through the material over the susceptor surface and then proceeds to at least one of the detectors;

detecting the emitted light with said at least one of the photodetectors;  
and

utilizing information about the detected light to assess the thickness of the deposited material over the susceptor surface.



52. The method of claim 51 further comprising estimating the thickness of the deposited material over the substrate utilizing the assessed thickness of the deposited material over the susceptor surface.

53. The method of claim 51 wherein the deposited material comprises silicon.

54. The method of claim 51 wherein the deposited material consists essentially of silicon.

55. The method of claim 51 wherein the deposited material consists of silicon.

56. The method of claim 51 wherein the deposited material comprises silicon/germanium.

57. The method of claim 51 wherein the deposited material consists essentially of silicon/germanium.

58. The method of claim 51 wherein the deposited material consists of silicon/germanium.

59. The method of claim 51 wherein the detected light is elliptically polarized light.

60. The method of claim 51 wherein the susceptor is within a reaction chamber, and wherein said at least one of the emitters and at least one of the detectors are also within the reaction chamber.

61. The method of claim 51 wherein the susceptor is within a reaction chamber, and wherein said at least one of the emitters and at least one of the detectors are not within the reaction chamber.

62. The method of claim 51 further comprising, prior to providing the substrate onto the susceptor, treating the susceptor to enhance deposition of the material over the surface of the susceptor.

63. The method of claim 62 wherein the deposited material is a second material, and wherein the treating comprises depositing a first material over the surface of the susceptor.

64. The method of claim 63 wherein the first and second materials both comprise silicon.

65. The method of claim 63 wherein the first and second materials are the same as one another.

66. The method of claim 63 wherein the substrate is a first substrate and is removed from over the susceptor after the second material is deposited onto the first substrate, the method further comprising providing a second substrate onto the susceptor, and, prior to providing the second substrate, removing the second material from over the susceptor surface.

67. The method of claim 63 wherein the substrate is a first substrate and is removed from over the susceptor after the second material is deposited onto the first substrate, the method further comprising providing a second substrate onto the susceptor, and, prior to providing the second substrate:

removing the first and second materials from over the susceptor surface; and

after removing the first and second materials, re-depositing first material onto the susceptor surface.